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It becomes our painful duty to announce to our readers, the death of the *Chevalier de Gerstner*, the distinguished Engineer, who has spent more than a year in this country, and in that time, obtained the good will and esteem of all who knew him.

The object of this gentleman in visiting our country, was to obtain the most exact information in regard to our railroads. He himself, had constructed the first railroad in Russia, had been one of the earliest advocates of the system, and had done much to promote it on the continent. From time to time, he had visited all of the public railroads in Europe, and with the information and experience thus acquired, he was prepared to make the most profitable application of his sojourn with us.

When the Chev. de Gerstner came into this country, our prospects in regard to Internal Improvement, were considered, and the friends of the system were almost derided for their adherence to that which in our legislative halls was pronounced as little better than a curse upon the nation, and which in our own and foreign markets, was considered as a bubble ready to burst.

At this stage of affairs, the most unpromising, it was to be expected that the unprejudiced opinion of an intelligent foreign Engineer, formed from a deliberate examination of our railroads, would have great authority. The result of the investigation of the Chev. de Gerstner, and his friend and assistant, Mr. Klein, are already before our readers, and their influence we conceive has already shown itself.

Independent of the loss to society of an amiable and accomplished gentleman, the Profession has lost much in the possessor of the greatest amount of precise information in regard to our railroads, ever collected by any individual. It is to be hoped, however, that Mr. Klein will be able to make such arrangements as shall conduce to the most profitable employment of the immense mass of information, in the collection of which he has taken so active a part.

We are reluctantly compelled to omit an important article, furnished by the politeness of *John M. Fessenden, Esq.*, for which he is entitled to our best thanks. Owing to an illness of our engraver, we have not yet been able to obtain the cuts. We hope, however, in the next number to furnish it to our readers.

For the American Railroad Journal and Mechanics' Magazine.

GENTLEMEN:—In one of the last numbers of your Journal there appeared an article, questioning the statements, and casting some reflections on the judgment and opinions of Professor Renwick, in his account of the steamboats of the United States.

We are always pleased to see any statements which may appear incorrect, commented on, and their inaccuracies pointed out, provided it be done in a proper spirit, and facts sufficiently strong are brought forward to refute them.

But, unfortunately for the writer of the above article, the assertions he makes cannot all be substantiated by facts, and we are compelled to make the following remarks, more from a desire of preventing any error in the public mind in regard to the present mode of constructing engines in this country, than from any fear that the reputation of the Professor would be injured by that article, though backed by an Engineer having such a practised eye, and extensive information as Mr. Ward asserts that he possesses.

At the same time, we cannot but express our wonder that the writer, urged on by his vehement desire to "do the State some service," has not before this time pointed out these errors, and thus prevented the construction of several new vessels on the principles advocated by Professor Renwick, in his article in Tredgold.

These have all been built since that article appeared in this country, which was more than a year ago, and we therefore are obliged to question the conduct of the writer, for not endeavoring before this, to prevent a method of construction, which he says is so highly dangerous to the safety of the public.

We do not consider the first three objections of sufficient importance to allow us to take up the time and space necessary for their proper discussion, and must therefore pass them without remark, and leave them, for what we consider the more important charges.

On the third page, the writer has gratuitously furnished the public with a table of his own, for the purpose of proving that the consumption of fuel in the American engines, which use steam of a high tension, is far greater in proportion to their power, than it is in those of English manufacture, which use steam of a far lower pressure.

The things in this table which are stated as facts, are not only contradicted by every valuable work on the steam engine and by practical experiment, but by the authority of the English, and the words of the great perfector of the engine, Watt.

In the first place, to show the gentleman that he knows nothing of the English method of calculating the power of an engine, and that therefore he is wrong in his comparison of powers, we refer him, and all your readers, to page 146 of Stephenson's Civil Engineering of North America.

The author of this work, an Engineer of some standing, there calculates the power of the Rochester to be equal to 748 horses, which is more than four times as great as Mr. Ward states it to be; and the power of the Great Western, when working at her usual rate, if tried by the same method, will be found to be about 450 horse. The ratio of consumption of fuel, then, instead of being in favor of the English, inclines not a little to the American engines.

Another proof of the economy of using steam of a high tension expansively, may be found in a description of the Cornish engines, on page 117 of vol. I, and page 49 in vol. II, of the Transactions of the Civil Engineers of Great Britain, to which we refer the writer. It will there appear that the Cornish engines have done more work than any others in England, with a given quantity of fuel, also that they use steam of a pressure of from 40 to 50 pounds, and work expansively; and on page 127 of vol. I, in the same work, he will find the words of Watt, himself, brought forward in proof of our statements.

Having thus given the gentleman a few facts, from the works of English Engineers, we furnish the following further proofs of the inaccuracy of his statements, which from the arrogant and unmeasured manner in which he expresses himself, he seems to think are so generally known to be correct.

These are to be found in the fact, that all the American steamboats of the latest and best construction, use steam of a high tension. Of these, besides those whose names he has so kindly furnished in his table, we may mention the Independence, Pasaic, and Raritan, all of which were constructed under the superintendence of Robert L. Stevens, Esq., an engineer who holds, deservedly, a high rank in the profession; and most, if not all, of our first Engineers, have adopted the same practice.

We may also state that the Russian steam ship now constructing, is to be furnished with tubular boilers and to use steam expansively, which methods have been preferred on account of their superior economy and lightness, by the engineers of that country now in this city, who may certainly be quoted as impartial judges.

We are now brought to the final charge, and the one on which the writer seems to have expended the whole virulence of his critical wrath, namely the danger which he says arises from the use of steam of a pressure of 30 or 40 pounds in steamboats, which in his opinion, "has already cost the lives of many hundreds, and if persisted in, will require the yearly sacrifice of, perhaps, hundreds more."

In this last sentence, the writer, with more modesty than appears usual to him, has, fortunately for his reputation, qualified his assertion, by saying,

"of, perhaps, hundreds more," leading us to believe that he is himself, in doubt of its correctness.

That this assertion is no longer a matter of opinion, will be seen from a memorial of the owners of our principal steamboat lines, in relation to the new steamboat law. From a table, on page 10 of this memorial which is grounded on pretty strong facts, and drawn up by Mr. Redfield, an Engineer of eminence, and which is approved of by James A. Stevens, James Cuningham, and several others, the following statements are deduced to show the comparative safety of the high and low pressure systems on the Hudson river and other waters near New York.

Mr. Redfield states, "I have separated the business of the fifteen years which it (the table,) comprises, into three several kinds, of five years each, commencing with 1824, early in which year, the navigation in this State, which had been previously controlled by the associates of Fulton and Livingston, was thrown upon to all competitors."

"On comparing the results of these several periods, the ratio of steam accidents for the first and third periods, as compared with the probable number of trips made, has decreased from 1 in 20,317 for the first period, to 1 in 317,105, for the third or latest period, showing a diminution in the ratio of accidents, in the average period of 10 years, equal to *about* 84 *per cent.* The average of lives lost from these accidents during the same periods, has also decreased, from 1 in 126,211, to 1 in 1,985,787; equal to a diminution in the ratio of personal hazard in this short period, of 84 *per cent.* The ratio of hazards in proportion of distance, is also reduced, almost 90 per cent."

By a reference to Mr. Redfield's table, it will be found, that the average pressure of steam during the first period was about 7 lbs. to the square inch, and during the third, 18 lbs. to the square inch, or more than a two-fold increase of pressure; yet notwithstanding this, that the accidents and loss of life, have diminished about 84 per cent., showing clearly that the mere pressure of steam is among the least important causes of danger.

We may add, that we have no written account, nor have we heard of any accident ever occurring in Cornwall, while it is well known, as may be seen by reference to Captain Pringle's report, made to the house of Commons, May 31st, 1839, that the accidents which have occurred to the English steamers which use low pressure engines, have been very numerous.

Professor Renwick has in no place stated, that explosions were not caused by the violent action of steam, suddenly generated, but that the *mere* pressure of steam determined by the load on the safety valve, is not to be feared; and that where the pressure is suddenly highly augmented through carelessness or accidentally, a boiler made for an expansive engine, is more likely to remain uninjured than a low pressure one, on account of the superior strength necessarily given to it—neither could he be expected to enter at large, into the causes of explosion in a paper like the present, but only give a brief view of his ideas on the subject, as he is evidently no

writing an account of the method of constructing and using boilers, but of the practice of American Engineers.

AN ENGINEER.

COMMON ROADS.

The subject of common roads, the first improvement of a new country, has not received that attention which the subject strictly demands. The object of all internal improvements should be the convenience of a travelling public, and the particular accommodotion of a few must in a measure be sacrificed for the many; that is, the greater benefits will result from the real accommodation of the public at large, although a few individuals may suffer some little inconvenience by it. All the works of improvement in a State or country are in a great measure dependent on the judicious location and grading of the common roads adjacent to, and leading from such improvements; from the fact that all the freight or passengers have first to be transported over a common road before they can be conveyed on a railroad or canal. Hence if a railroad has superior advantages from its easy gradients, a common road will certainly have advantages by easy gradients and circuitous routes, over those that are located on the tops of the highest hills to accommodate one or two individuals, by passing through their farms without regard to hills or valleys, which will cause great undulations in the surface of the roads.

Every person who travels over a road injudiciously located, is taxed for the ignorance of the highway commissioners. Persons holding that office in almost every town, are not qualified to calculate force and resistances, or the firiction of carriages on common roads. Hence the calculation of the resistances does not enter into the account for locating common roads thro' a hilly country. Now the fact is, that most of the great thoroughfares in the shape of common roads in this State traverse very hilly countries, and if there had been some little instrumental examination made, and a calculation of the force necessary to draw a given load, taken into consideration, the character of common roads in the State of New York would have been materially altered.

The changing of a route when it is once located and graded, is seldom resorted to, but at a sacrifice of time and money; for the cost of making two roads, and those but poorly constructed, would doubly benefit the public if it was all expended on a road carefully located. That we have greater difficulties to encounter in the construction of roads through the different parts of the State than other portions of the United States is denied.—Some of the eastern States are more mountainous than the State of New York, yet their roads are much less undulating, and the highest elevations are overcome with the greatest ease, so that their stages travel from eight to twelve miles per hour; while ours, on most of the important routes, are compelled to drag along at the slow rate of from two to four miles per hour. In the location of common roads, and finally all kinds of improve-

ments, intended for the conveyance of freight and passengers; the ease of the moter should be duly considered, because it is the actual saving of property in such moter.

The experiments made by Mr. Telford on the draught of carriages on different kinds of roads, prove that the force of traction on the best of roads necessary to draw the weight of one ton is as follows:*

1st.	On a well made pavement,	33 pounds
2nd.	On an old broken stone surface,	65 "
3d.	On a gravel road,	147 "
4th.	Broken stone upon a rough pavement foundation,	46 "
5th.	Broken stone surface upon a bottoming of concrete,— formed of Parker's cement,	46 "
	The mean of which is	77 "

Which is more than eight times the traction of a railroad, and this estimate in both cases is made for the resistance on a level plane. Now the best common roads in the State of New York, are not better constructed, if they are as well built as the gravel road on which Mr. Telford made his experiments.

Taking, then, 147 lbs. as the traction of common roads in this State, which on an inclination of four feet in one hundred, gives a resistance of 256 lbs. necessary to give motion to a weight of one ton, and on an acclivity of twenty feet in one hundred, one ton would require a force of 595 lbs. to cause motion, which, including the carriage, will require a force of about 900 lbs.

Common roads should never exceed an acclivity of four feet in one hundred, ($\frac{4}{100}$) which can be the maximum grade, without materially increasing the expense of construction and which will enable loaded trains to pass over the road with ease, and overcome at the same time an ascent of more than two hundred feet per mile. Many roads are located with an inclination of some thirty or forty feet in a hundred, in which cases the force becomes nearly equal to the load.

It is not my object in the present commnnication to define any particular method of legislation, by which the remedy for this evil may be found, but merely to show that the present management, location and construction of common roads are not based upon the most strict principles of economy.

S. L. W.

Dunkirk, March 31*st*, 1840.

* Report of the Holyhead road commissioners.

WESTERN RAILROAD.—*Reduction of prices.*—A pamphlet of 50 pages, recently issued at Boston, entitled "Proceedings of the Annual Meeting of the Western railroad Corporation," touches some topics of interest to this city, particularly the reduction of the rates of freight and travelling on said road, and the object of said reduction. The fare between Springfield and Boston, is now only $2,50 for passengers—being a distance of about 100

miles. The object of this, and of the corresponding reduction of freight, is, of course, to "conciliate," as they express it, the trade of the Connecticut Valley towards Boston; (*alias* away from New York) and of this result they appear to be sanguine. As the matter stands *now*, or did lately, they show, that a country trader who goes with a ton of produce from Springfield to New York, instead of going to Boston, and returns with a ton of goods, although he travels 130 miles farther, saves six dollars on the way. This great disparity is itself the result of comparatively *low rates*. It is the effect of Steamboat navigation; for, 20 years ago, the Committee say, the trade of the Valley was chiefly with Boston, whereas four-fifths of it are now with New York. And as the one change has been effected by reduction, so, they argue, must be the other. What Steamboats effected *then*, the railraod must effect *now*. Putting the rates at $2,50 for passengers and $3,75 the ton of merchandize on the route above mentioned, will accomplish it, they say. It will "*control the travel and buisness of the great valley*;" and they are satisfied that a train of cars, carrying 200 passengers, and a train of freight-cars having at least 60 tons of merchandize, may be propelled from Boston to Springfield for less than $100 each, inclusive of supervision, motive power, wear and tear of the cars, engine and road, and all incidental expenses, making an outlay of 50 cents for each passenger, and but $1\frac{2}{3}$ for each ton of merchandize. All their officers and agents concur in this; and so it is now settled.

The committee appear to have considered this step a very important one; and though unanimous about it at last, they fully weighed a vast mass of evidence, bearing on the point of moderate charges. The history of all the foreign roads was laid before them. In the case of the Belgian, it was found that *they* have cost over $41,000 per mile, or $5,000 per mile more than the Western. That the entire expense of sending a train over them is $15-100, or at least 5 cents per mile more than the cost upon the Western; but the average charge for passengers has been only 11-10 cent per mile, equal to a charge of $1,08 between Springfield and Boston; and yet these roads, at this charge, have afforded an ample income, paying a fair interest upon the outlay. In 1838 the receipts between Antwerp and Ostend, 159 miles, were as follows: 17,503 passengers, first class at $2\frac{1}{2}$ cents per mile each, who paid $13,171 18; 215,893 passengers, second class at 2 cents per mile each, who paid $133,475 38; 604,935 passengers, third class at $1\frac{1}{2}$ cent per mile each, who paid $196,451 07; 1,343,354 passengers, fourth class at 8 mills per mile each, who paid $206,680 00. Average number to each train 143; actual expense of carrying each passenger 73-100 per mile, or a little less than $\frac{3}{4}$ of a cent per mile.

The American roads are next referred to. The Salem road, for example, carries 6000 passengers a week, a distance of $13\frac{1}{3}$ miles, and across a ferry equal in distance to four miles more of railroad, for the moderate charge of half a dollar each; and now the number of passengers upon it is more than double that originally estimated. This is ascribed to reduction, the rate being but half the stage-fare; and again, still later, between Salem Marblehead (5 miles) a few months since, a single coach usually conveyed the passengers, who rarely exceeded a dozen per day, at a charge of 25 cents per passage; but since the locomotive was set in motion, the number at $12\frac{1}{2}$ cents has been as high as 200 a day. Extending these observations, the committee proceed to notice the vast increase of passengers in steamboats, upon the coast of Maine, the North River and the Sound, since the reduction of charges; the astonishing numbers that pass between Boston, Nahant, Roxbury, Charleston, and Cambridge, since the establishment of cheap steamboats and omnibuses; the striking results which have attended the

reduction of postages, of the price of tickets for concerts and theatres, the cost of luxuries, the extension of commerce, at low rates of premium; the wide and increasing circulation of the penny press; the wonderful growth of the ice trade, which under the system of low charges, has so expanded, that it adds annually 30,000 tons to the exports of Boston, and supplies at least 100 sail of ships with cargoes; and more particularly to the great increase of the revenue of the New York canals, and gain in the aggregate receipts of these canals, which has attended three successive reductions of the tolls. These facts are doubtless to the point. They are such as have influenced the owners of the Atlantic steamers and the lines, still more lately, in similar reductions. The same philosophy appears in the new rates of the Norwich route. It appears in all quarters; in fact, it is the order of the age. The Worcester company are only a little earlier, and so much the wiser, than some of their old fashioned and narrow minded cotemporaries. A little we say, for even the Providence company have struck their flag at last. And so must all the rest do sooner or later. They must reduce. To this effect, the facts, as well as the reasoning, are very strong. We notice, that in consequence of rumours heretofore respecting an experiment tried on the Worcester road, the committee come out with a statement, the amount of which is, that in December 1836, they raised their fare (to Worcester) from $1,50 to $2, and again reduced it to the original price in May 1839. To remove mistakes as to the real result, they cite the return of the number of passengers on the Worcester railroad, for four successive years as follows:—

1836	Rate,	$1½	No. of passengers,	78,088
1837	"	2	"	61,666
1838	"	2	"	56,016
1839	"	1½ two thirds of the year,		75,230

On the whole, the road, in spite of hard times and every thing else, has been going ahead. It has always been at least a six per cent. stock. From the *Western* road still more is expected, running into a new region of Massachusetts, as it does, whose exports and imports are about 150,000 tons a year, and to connect with the Hudson and its commerce of a million of tons the year. Thus, by the section already finished, the committe expect to conciliate a business equal to 50,000 tons of goods and at least 60,000 passengers per annum, to be derived entirely from the resources of the railroad East of the Connecticut, and increasing at a rate not less than 10 per cent. a year; and then much stress is laid on the time when "this great avenue of commerce shall consumate its union with the canals and railways of New York," becoming part of a line from Boston to Buffalo, or connecting with the ocean steam packets the steamers of the lakes and the canals of the west, and entering into a continuous route from England to Cincinnati, Louisville and St. Louis, "as well as the most direct, expeditious, cheap, and least fatiguing route between those great marts of commerc."

The committee do not forget to hint that the produce of the West finds its *best* market at Boston, and of course would *like* to go there; while the great Boston Yankees find their most extensive markets also at the West.

They mention, moreover, the facts that at least 15,000 persons weekly ascend and descend the Hudson; that at least 30 packets and transient vessels ply between Boston and Albany, besides vast numbers which bear the produce of the West from New York; that more than 100,000 barrels of flour are annually boated up the Connecticut above Springfield; "that in the hills of Berkshire the Western railroad intersects quarries of lime and marble, which will supply the valley of Connecticut and the entire country bodering on the road; that as soon as this great artery of the State is finish-

ed, and the sections between it and Buffalo are complete, a passengers may pass almost without fatigue in eleven hours from Boston to Albany in thirty hours from Boston to Buffalo, in six hours more to Erie, in six hours thence to Cleaveland, and in two days and a half from Boston to Detroit.

EIGHTH REPORT OF F. R. HASSLER, AS SUPERINTENDENT OF THE SURVEY OF THE COAST OF THE UNITED STATES, AND OF THE CONSTRUCTION OF STANDARDS OF WEIGHTS AND MEASURES; RENDERING ACCOUNT OF THE WORKS OF 1839.

(Continued from page 275.)

Upon the construction of the standards of weight and measures.

1. Since my last report upon these works, the full sets of weights for all the custom houses have been delivered and destributed according to their destination.

2. Weights had been prepared to become, when standarded, the heavy ounce weights for the mints, to be grounded upon the sets of ounce weights till to the one hundred onnce weight, which were delivered to the mint in Philadelphia, early in 1838, as has been reported upon in proper time.

The mint having, in the meantime, constructed more accurate balances, desired for the sake of acceleration, to receive these weights in that unfinished state, and adjust them in their own establishment. This being granted by the treasury department, the whole of the sets, with their packing boxes, etc., complete, were delivered to the director of the mint at Philadelphia, and also the beam of an unfinished brass balance, of large size, which had been begun, and which they were in need of, to assist in the adjustment of the weights delivered.

3. The principal attention in the way of adjustment of standards this year, was put upon the numerous yards ready for it, a task which it is impossible to make hasty, and which requires in all cases continued and very fatiguing application; many thousands of microscopic observations are required for it. The specialities of these minuted parts of the work belong rather to an ultimate full account of all the means and methods employed in the execution of the whole task of the establishment of the standards which it will then be proper to publish, and distribute on government account, like a similar account of the works of Mr. Bessel, of Konigsberg, for the establishment of a standard length measure, has been published lately by the government of Prussia.

4. The feeling lever apparatus, which Professor Bessel has directed to be made for this establishment, at Berlin, he has lately announced to me as being nearly ready, so that it may perhaps yet arrive before the final delivery of the yards. This would afford the opportunity of establishing some comparisons by two methods, by the microscopes, and by the lever, which would be the more desirable, as the latter is intended to remain in the establishment for future use in comparisons.

5. A number of yards sufficient to furnish all the States are ready; but it is not proper to deliver them as yet, as it will tend to more accurate coincidence, to combine more numerous comparisons, under a variety of temperatures, and with different means. Besides the original standard scale of eighty-two inches, described in the report, upon the comparison of the weights and measures of the custom houses, various other sets of microscopic arrangements were constructed, and constantly employed, whereby always a number of comparisons are carried on at the same time.

6. The form of the yards is that which has been formerly already mentioned, as best adapted for the preservation of their accuracy; the yards being cut to a length, in about the half breadth of a strong brass bar, and

fitting between the butting pieces at both ends of a similar bar of equal thickness, which it fills exactly, so that when joined they form one piece, and nothing can ever touch the ends, which determine the exact length: this arrangement presents evidently two different means of ascertaining the length of the yard to the nicest; but it should be used only when it is desired to give the length of other yards that are intended *to form again standards.* For the transfer of the yard for common purposes, there is a special decimally divided length of a yard traced upon the outer piece of the yard, or matrix, between two parallel lines. A tracing arrangement is given with it, by which means, the yard being left undisturbed in its proper place, in the box fitted for it, a bar of metal, or wood, for which a location is made parallel to the yard, can be laid off and subdivided without in any way injuring the original; the use of this will be described in a statement to be added, as instructions at the delivery of the yards. My assistant worked at a considerable number of these divisions, until interupted by sickness.

7. Of the liquid capacity measures the full number is finished, until to their adjustment, which requires their being weighed filled with distilled water, at the temperature of the maximum density of water, which is a most tedious and minute, therefore not very quick operation.

For the use in it a special balance has been constructed. Their actual adjustment will begin immediately after that of the yards, when the arrangements which it requires will be completed. Handles of a peculiar construction, to take off and put on, are constructed for their proper manipulation, in use, without changing in the weighing.

8. As it is necessary to close the tops of the vases exactly at the proper height, to contain a determined weight of distilled water, at a given temperature, in a given cubic space of a brass vessel, it is necessary that this vessel be *exactly* covered, no air bubbles admitted in it, and no overflowing; to effect that, glass plates are required, exactly plane, of proper thickness, ground, unpolished on the side which touches the liquid, and of the size of each vessel's top; only large plate glass factories can procure these good; to construct them expressly would have necessitated a great establishment, different in its kind from all that is now established, therefore these plates have been ordered at the manufactory of plate glass of St. Gaubin, where they can be made with ease; which has established arrangements for such works, and can execute them at short notice, and with proper accuracy; they will perhaps cost a great deal less than in any other way.

9. The half bushels require a manner of casting, different from that of the other parts of the works, which takes also more time and special cares; it has been in full operation as much as possible; but this casting cannot be made in our establishment at all seasons of the year with equal success, and will, therefore, suffer temporary interruptions; during which other castings are executed. Some of these half bushels have also been turned; but it is evident that in the proper order of the work, there could not yet be any attempt toward their adjustment. The glass plates, that shall serve to cover them, have been ordered, together with those for the capacity measures for liquids for all of them; the proper size has been given to the factory for guide.

10. Thus it appears that the different tasks of the establishment for standard weights and measures have advanced properly, each in that proportion which the kind and the quality of the work they require, indicate naturally as the time required for their execution. The weights being already fully executed and delivered, except the ounce weights for the States, have made known in the country what is to be expected from the establishment,

and have, I believe, given general satisfation, which I doubt not every part of the works will give, whenever it appears before the public.

F. R. Hassler.

Station of Willow Grove, Pennsylvania, November, 16, 1839.

ON THE MODE OF PROCURING FAC-SIMILE COPIES OF MEDALS, ETC.—BY THE AGENCY OF VOLTAIC ELECTRICITY.

Sir—You request a condensed account of my voltaic process of working in copper. I shall endeavor to give you one, premising, I shall divest it as much as possible of electro-chemical detail, that it may be rendered quite intelligible to those unacquainted with that science.

It has been long known that one metal will precipitate another from its solution. As one instance, if we take a solution of the sulphate of copper, the blue vitrol of commerce, and dip the blade of a penknife in it, in a few seconds it becomes coated with pure metallic copper. We have here an instance of simple electro-chemical action, and I may say, the type of all the experiments I have lately published on the subject. Subsequently, it has been found that copper itself possesses this quality, by acting on *its own* solutions, and to a much greater extent than in the first instance, but under a somewhat different condition.

If we take a clean copper wire and dip it into a solution of the sulphate of copper, on taking it out, we find no perceptible difference is made on its surface. If we now take the copper wire, or slip of that metal, and solder to one of its ends a piece of zinc, and bend the two metals so combined into the shape of the letter U, and again place the copper end in the cupreous solution, and the zinc end in a very weak solution of salt and water—if allowed to remain some time, it will be found the copper end has received a thin coating of solid copper. In this instance, as in most others connected with continued galvanic arrangement, it is a *sine qua non*, that the two fluids must *not* be allowed to intermingle, yet must be *in* connection with each other.

To effect this, various expedients have been resorted to, with more or less success; but to give a simple illustration of how this may be effected, in order to attain the result mentioned above, take a piece of *stout* brown paper, and bend it into the form of a piece of tube about three inches long and perhaps an inch in diameter. This may be conveniently done, by bending the paper round a phial to make it assume the desired form; let the edges of the paper overlay, and fasten them together with a bit of sealing wax. A paper tube is thus obtained, open at both ends, but one end must be closed; this may be done simply, by cutting a piece of card into the shape of the bottom end, but a little larger, and fastening it on with sealing wax, just as we would take an impression of a seal, by covering the disc of card with the wax, and while soft dip the end of the paper tube into it; when set, we shall thus obtain a vessel capable, to a certain extent, of containing a fluid, yet from its porous texture, this fluid would be in connection with any other fluid that might surround it on the other side.

Having obtained such a tube, we three parts fill it with salt and water, or better still, glauber salt and water, which is a sulphate of soda. We then take a common drinking tumbler, containing a quantity of sulphate of copper in solution, and take the paper tube containing the saline solution, and immerse it in the tumbler, taking care that both fluids shall attain the same level. If we now take the bent slip of copper and zinc, and place the copper end of it in the cupreous solution, and the zinc end in the saline solution, contained in the paper tube, and let this remain at rest for a few

hours, (if in a warm situation so much the better,) it will be found on removing the combined pieces of metal, that the copper end has obtained a solid covering of pure copper. I have here described an elementary voltaic battery, and the most extensive one ever constructed, is only a combination of such simple arrangement connected together by copper wires.

In this arrangement the inside of the paper tube, containing the saline solution, is termed the positive cell—the outside one—the tumbler containing the cupreous solution—is termed the negative cell. The zinc end of the combined metals, is termed the positive electrode—the copper end—the negative electrode. With a modification of this very simple apparatus, all the experiments of this process may be readily performed. I have judged the above explanation necessary, as many persons have imagined the apparatus when constructed, was in some way or other connected to a galvanic battery.

By performing the above experiment, we acquire a clear idea of voltaic arrangement, while the eye becomes acquainted with the phenomena produced.

Were I required to produce an exact fac-simile of a medal in copper, I should proceed as follows :—Suppose it were equal in size to half-a-crown —I should procure a piece of glass tube (a short gas glass of the largest diameter does best) and then take a piece of flat glass and oil its surface slightly—this done, I place one end of the tube on the oiled glass, and pour into it some fluid plaster of paris, to the depth of one-half or five-eighths of an inch ; when this sets, the oiled glass will slip easily off, and a porous bottom will thus be given to the tube, which in all cases should be of equal or superior diameter to the medal required to be copied. This and a common sized drinking tumbler, comprehends nearly all the apparatus required.

I should now procure two pieces of pretty thick sheet lead, and with a plane, smooth one of the surfaces of each piece in the manner wood is planed. I then take the medal to be copied, and place it between the bright surfaces of the pieces of lead, and place the whole under a press. Should the medal not be very large, a copying press will be found sufficient, but when larger, a more powerful one is requisite. In either case the object to be acted on must be under the centre of pressure.

When removed from the press, a most exact mould of each side of the medal will thus be obtained. I now take a piece of copper wire, varying in length according to the size of the apparatus—in the present instance, from 12 to 16 inches may be used. To one of its ends, I solder a piece of zinc, rounded, and sufficiently large to go into the gas glass. To the other end I solder* one of the leaden molds. I have now what is termed a "galvanic pair," the leaden mould constituting the negative electrode, and the zinc the positive one.

The wire is now bent in such a form, that the lead and the zinc will be opposed to each other—the opposed surfaces being distant about one and a half inches. To effect this, bend the wire into a right angle, at its junction with the lead, and place the lead in a horizontal position, at the bottom of the tumbler, the impressed side being uppermost. The gas glass, with its plaster bottom, must now be placed exactly over the lead mould.† The wire must again be bent in the shape of the letter U, in order that the zinc end may go into the gas glass, and *touch*, or nearly so, its plaster bottom. This like the lead, must lay horizontally, on the bottom of the interior cell.

* The wire should be soldered to the blank side of the lead.

† In order that the gas glass may not *rest* on the plate to be deposited on, I suspend it by a wooden collar, which rests on the outside vessel, and keeps the bottom of the inside one, at a quarter of an inch distant from the plate.

To conveniently effect this, the end of the wire should be soldered to the centre of the zinc disc.

These arrangements being neatly effected, I now pour a hot saturated solution of sulphate of copper into the tumbler, being in connection with the lead. A few undissolved crystals may be added with advantage. I next pour a hot solution of glauber salt into the gas glass, in connection with the zinc, taking care it does not exceed the level of the fluid in the outside cell. This latter solution must not be saturated, but only a few crystals of the salt put in the water. This may now be allowed to remain for a day or two, until the blue color of the cupreous solution is assuming a pale green; then add a few crystals of the salt of copper.—Should a very thick deposition of copper be required, it is well to renew the solutions entirely, as the acid that is set free, materially interferes with the success of the process.

This process may be quickened in a very great degree, by the application of heat, and the metal so deposited, is of a much superior character to that deposited under a common temperature. The apparatus I have described, may be kept at a temperature of from 120° to 160°, by being placed at the side of a fire, and a deposition got in a few hours.

When it is judged the requisite thickness is deposited, I proceed to get the copper so deposited, off the mould as follows: Previous to immersing the lead into the solution, I generally varnish the back and edges of the mould, to prevent deposition on any other portion of its surface than that opposed to the zinc.

On removing it from the apparatus, I file the edges of the copper until they are flush or parallel with the lead. I then heat the copper side by holding it over the fire, and suddenly plunge it in cold water. On examination it will be found some portion is loosened from the lead, when, by inserting the edge of a knife, the plate of copper will come readily off, bearieg a *most exact* impress of the original.

I have thus far described how to proceed, in the progress of taking a single medal; but it will at once be perceived, that the same instructions apply to a sheet containing an indefinite number by only enlarging the apparatus. By exactly the same process here described, I have succeeded in obtaining exact copies of engraved wood blocks and copper plates. I have also succeeded in stereotyping in copper, some elaborate ornamental printing, equal in area to a large octavo page.

I have used lead for most of my latter experiments, instead of copper—as that metal percipitates copper, when in connection with zinc, and it is much easier got off the mould, in consequence of the different degrees of expansibility possessed by the two metal, on the application of heat. The time occupied by the whole process is also materially abridged. I have not yet had an opportunity of trying the "fusible metal," that melts at a temperature of 212° F. It must also be borne in mind, that as far as our knowledge extends, it is an electro-chemical law, that a *metallic* surface must be present, before we are able to precipitate a metal from its solution.

Want of space compels me to omit several minutiæ, that my experience has suggested, but enough has been said to illustrate the princple, and I may add, it is susceptible of infinite variation.

I have every reason to believe it might be found advantageous to type founders, for the matrix from which they cast type, as copper precipitates very readily, on a surface of type metal.

In conclusion I may add—I have no personal intention of turning this process to pecuniary advantage—should it be capable of being so applied,

but should at all times feel happy in communicating my experience of the matter to those desirous of applying it in the arts.

My own expectations have been fully realised, as it has been a means of illustrating a hitherto unsolved geological problem, in connection with some peculiar views I hold on the subject.

THOMAS SPENCER.

Liverpool, Dec. 14th.

Internal Improvements.—Yesterday the two houses passed the bills in aid of the New York and Erie, Hudson and Berkshire, Auburn and Rochester, and Long Island railroads. They had previously passed the appropriations for the enlargement of the Erie canal, and for the prosecution of the Black river and Genesee Valley canals. The appropriations, so far are, as follows:—

Erie Canal enlargement*	2,500,000
Genesee Valley Canal	500,000
Black River Canal	250,000
N. Y. and Erie Railroad†	400,000
Hudson and Berkshire Railroad	150,000
Auburn and Rochester Railroad	200,000
Long Island Railroad	100,000
	$4,100,000

In addition, the bill appropriating $100,000 in aid of the Harlem railroad has passed the Senate, and the bills in aid of the Tonewanda railroad and for the purchase of the Oneida Lake Canal and feeder, the former $100,000 and the latter $50,000, have passed the Assembly.

MEMORIAL OF SUNDRY PROPRIETORS AND MANAGERS OF AMERICAN STEAM VESSELS, ON THE IMPOLICY AND INJUSTICE OF CERTAIN ENACTMENTS CONTAINED IN THE LAW RELATING TO STEAMBOATS ASKING TO BE RESTORED TO THE RIGHTS AND PRIVILEGES WHICH BELONG TO OTHER CITIZENS ENGAGED IN NAVIGATION.

To the Honorable the Senate, and House of Representatiaes of the United States, in Congress assembled:

The memorial of the undersigned, proprietors, managers and agents of american steam vessels, respectfully showeth:

That for several years, your memorialists have been actively engaged in steam navigation: and that, in thus employing a power which is universally known and acknowledged to be hazardous in its nature and use they claim to have afforded and maintained a degree of security, in the transportation of persons and property, which has not been equalled by any other known means of transport or navigation. This important fact, so contrary to public apprehension, we trust will appear from the annexed documents, and also from any just and accurate comparison of the average losses and casualties by steam, with the average losses and casualties which occur in other modes of navigation or transport.

For these results, which are on the whole so favorable, the public are not indebted to incentives furnished by pecuniary rewards; for your memorialists believe, that no interests involving such vast investments of capital, have generally been less productive. Nor is the present degree of

* An appropriation of $500,000 early in the session.
† For this year, and an indefinite sum for the future.

security due to any interference of the government with the mechanical arrangements and prudential management of our steam vessels, or to the enforcement of novel and severe principles of legislation; but has been owing to the inventive and discriminating powers, prudent foresight, and persevering spirit, of those who are engaged in this important branch of national enterprise.

This spirit of national enterprise, producing results which have generally been more and more favorable to the security and advantage of the public, has continued in full activity to the present hour; with a firm reliance, on the part of those engaged, upon the guardianship and protection which is due from the government of this vast country to an interest which is inseparably connected with it principal business relations and public resources, and which is destined to advance our country to the highest point of prosperity and power.

Your memorialists further represent, that certain enactments of peculiar novelty and severity, found in the act of Congress of July, 1838, are calculated to bear harshly and oppressively upon the owners of steam vessels and thus to affect injuriously this important branch of our navigation.—These enactments, instead of furnishing encouragement for a just and generous rivalry, in bringing steam vessels and their machinery to the highest possible state of security and perfection, have unfortunately, in the view of your memorialists, a direct tendency to deter men of prudence, capacity and property from further connection with this business; who are unwilling to submit to implied reproach and degradation, to unwarranted hazards, and to the loss of rights and privileges which are guaranteed to all other persons engaged in a lawful calling. Your memorialists refer more especially, to the clause which deprives them of the universal legal protection common to every civilized country, by unjustly construing, in the event of any serious disaster to life and property, the presumption of innocence into *prima facie* evidence of guilt; and they respectfully request of your honorable body, that a provision, which is so much at variance with their fundamental rights and privileges as American citizens, may be repealed.

It is with painful regret that your memorialists have noticed an attempt to procure a broader and more mischievous application of this unjust principle, by means of proposed additions to this law; and they respectfully ask of Congress to be protected from such proposed aggravations of the already severe and relentless doctrines of the common law as it now governs the responsibilities of common carriers; and which, if enacted, must tend to destroy every just inducement for longer continuance in a business which is subjected to such unprecedented liabilities to loss and ruin.—These extraordinary hazards and liabilites, it should be noticed, will not pertain to our competitors under a foreign flag; and our citizens may thus be virtually excluded from navigating the ocean by steam. Your memorialists would further remark, that if with the best knowledge possessed by this or any other country, this species of navigation be deemed too hazardous for the public safety, they deem it more just and honorable to submit to its entire prohibition.

Your memorialists believe that few opinions are more erroneous than that which ascribes to the provisions of the existing law a generally increased safety for persons and property carried in steamboats. This may appear from the many accidents or disasters of a serious character which have taken place during the short period in which this law has been in force. The number of these accidents on the western waters during the last year is stated to have been forty; which may serve to convince Con-

gress that the appropriate remedies for these disesters are not furnished by this law; and can be found only in the increasing practical knowledge and skill of those persons who are engaged in the construction and management of steam vessels.

Your memorialists do not seek to escape from any just responsibilites in conducting this important business. On the contrary, they feel bound to furnish every reasonable guarantee for safety to life and property which human foresight and prudence may be able to afford; and it is for the purpose of furnishing these guarantees in the most direct and practical manner, that they further respectfully but earnestly request, that Congress will call to the aid of its committees, to whose protection this important branch of navigation has been intrusted, the information and experience of some of the individuals whose lives have been devoted to its improvement and practice from its earliest origin in this country:—in order that practical knowledge may form the basis of legislation upon a subject which affects more or less directly the interests and business of, probably, a great majority of the American people.

All which is respectfully submitted.

New York, February 22, 1840.

MEMORIALISTS.	STEAM VESSELS OR LINES REPRESENTED.
A. N. Hoffman, James A. Stevens, Robert Dunlop, Jonas C. Heartt, Richard P. Hart, Daniel Drew,	North river line; steamboats Albany, De Witt Clinton, Swallow, Erie, Champlain, John Mason, Columbus, Union, General Jackson, R. L. Stevens, J. C. Heartt, Rochester, Utica and Saratoga; about 5,500 tons; navigating about 250,000 miles annually.
W. C. Redfield, A. Van Santvoord, Isaac Newton, Henry Green & Co., Pope Catlin, Horace Stocking, Joy & Monteith, Charles S. Olmsted,	Steamboats Swiftsure, Constitution, Commerce, Illinois, Sandusky, Mt. Pleasant, O. Ellsworth, U. States, H. Eckford New London, J. Fairlie and John Jay, with 54 steam freighting vessels; aggregate, 13,000 tons; navigating an aggregate of about 330,000 miles annually.
David Crawford,	Steamboat Washington, Newburgh line.
Benjamin Carpenter,	" James Madison, "
Jackson Oakley,	" Superior, "
Thomas Powell,	" Highlander, "
M. Sandford, Charles H. Northam, S. B. Stone,	Steamboats Splendid, New York, Bunker Hill, Charter Oak —1,580 tons; New Haven and Hartford lines; navigating about 60,000 miles annually.
William W. Coit,	Steamboat Norwich; Norwich line.
Thaddeus Phelps, Nevins & Townsend, Richard S. Williams, James G. King, C. H. Russell, Wm. Comstock,	Steamboat Massachusetts, Narraganset, Rhode Island, Providence and Mohegan; 2,700 tons; navigating about 120,000 miles annually.
James Cunningham,	Steamboat Huntress, North America and Thorne.

With many others not printed.

Appendix A.

No. 1.

The following communication was made by request to the commissioners appointed by the English government for conducting an inquiry into the causes of steamboat accidents and the practical means of preventing their recurrence.

To Capt. J. W. Pringle, R. E.

Sir—Having received through a valued friend, a copy of the circular issued by the lords commissioners of the board of trade, which authorises an inquiry through the agency of yourself and Mr. Parke "into the nature and causes of the accidents which have occurred in steam vessels, and whether any measures can be taken in order to prevent the recurrence of such accidents," accompanied also by a request for my views on this subject I will cheerfully respond to the inquiry in such manner as is suggested by my own experience and observation.*

The accidents comprised in this inquiry may be classed under the following heads:

I. Accidents by shipwreck.
II. Accidents by collision.
III. Accidents by fire.
IV. Accidents by explosions, or by the injurious escape of steam.

The following suggestions on these several topics are offered for your consideration.

I. The liability of steam vsssels to shipwreck or loss at sea by stress of weather, may chiefly depend on the following causes or considerations:

1. The ability to avoid being stranded or cast on a lee shore, as in the case of the Rothsay castle, the Killarney and the Forfarshire steam vessels must depend mainly upon the power which can be commanded for encountering successfully the winds, tides and seas, and for keeping the vessel manageable or under the control of the pilot or navigator.

This power must depend: 1. On the general rate and efficiency of the engine: 2. On the ratio of velocity, or in common sea laaguage, *purchase* between the piston and the paddles:† 3. On the strength of the boiler, and its security from inundation; The boiler if near the bottom of the vessel, being liable to have its fires extinguished by any accidental accession of water in the hold.

2. The liability of the hull of a steam vessel to receive injury from stress of weather, when clear of the land, as in the cases of the English steamer Royal Tar, in the Bay of Biscay, and the American steamboat Home, on the coast of North Carolina, appears to depend greatly on the mode of construction which may have been adopted. Steamers require a greater proportionate length than is given to other vessels, and being oftener kept up to the wind and sea, they are more liable than other vessels to suffer from straining. The best remedy which is suggested for this evil, consists in a change in the system of naval construction. In the present system, reliance is mainly had upon spikes, bolts or tree nails driven traversly, and aided also, in some cases, by longitudinal bolts, bedded in the vessel's frame; but no effectual measures have been taken to transfer the laboring strain which falls latterally upon the fastenings and their bearings,

* This communication did not reach England till after the publication by Parliament of the report made to the government by Capt. Pringle and Mr. Parke.

† The advantages of an increased ratio of velocity in the piston are far more important in stress of weather than in the ordinary circumstances of navigation.

to the timbers and planking or the mass of woody fibre. Hence, when a heavy stress is thrown upon the fastenings, their bearing surfaces in the wood are found to yield, and even the fastenings themselves become subject to flexure. Thus the planks are moved, the seams are loosened, and water is admitted, to the immediate hazard and damage of the vessel, and causing also a premature decay.

I propose as a remedy for this evil, that the frames of the vessel, (if closely built,) be so moulded as to project alternately inward and outward, to the extent of say three-fourths of an inch beyond the general surface, so as to form alternate projections and depressions on both the interior and exterior surfaces of the framing. Each plank should be of somewhat more than the usual thickness, and is first to be fitted to its place, and its bearing surface then cut out in such manner as to receive the projections of the framing in the closest manner; the several butts being scarfed so as to lock the continuous planks together by means of one of the projecting frames. After laying three or four planks in this manner, the next one is to preserve its full thickness throughout, and is to be let into an opening which is nicely cut to the depth of the projections of the frame, so as to interlock against the lateral or calking strain to which the planks and timbers are exposed; and these modifications of the interlocking process are to be repeated throughout the planking, except, perhaps, in some parts near the extremities of the vessel where the strain is less, and the greater bending of the planks may render the overlocking part of the process too inconvenient.

On this plan, the strain upon the fastenings is chiefly longitudinal, and they perform little other duty than that of holding the several parts of the structure in close contact; while the great strain which results from the weight and throw of the vessel and her cargo by the power of the sea, is brought to bear upon the general mass of woody fibre which is used in construction, and which is competent to sustain it without the least injury; while, in the usual system of construction, perhaps more than two-thirds of the wood employed is quite unavailable for the support of the vessel against heavy straining at sea; and contributes also by its weight to the strain upon the fastenings.*

II. *Accidents from collision.*—These, it is believed, are mostly owing to the want of a simple and well digested system of regulations for the government of vessels which are steering in opposite directions, especially in the night season, or in thick weather. Various plans have been recommended in Europe and America, but I know of none that I think equal to the system established on the waters of New York; where, with perhaps the most active night navigation in the world, accidents by collision have now become quite rare.

It is important for each pilot or navigator of a steam vessel to be able to understand the course or courses which are steered and will continue to be taken by the vessels which he may meet. For this knowledge we must chiefly rely upon a judicious system of lights and upon the reasonable presumption that no steam vessel will vary from its usual and proper course without good cause.

Owing to their sharpness and great length, steam vessels are not adapted to turning and dodging in their course; for any such practice is highly dangerous, and should never be attempted. If a slight variation of the

* In this plan of construction it is not intended to dispense with the auxiliary aid of a system of diagonal braces and riders, which should also be interlocked with the vessel's side. But diagonals will be of little benefit if secured only by the common lateral fastenings.

course be judged insufficient for avoiding collision, the proper alternative is to stop instantly and work the engine aback.

In this quarter, when steamers are likely to *meet* each other on opposite courses, each keeps sufficiently to the right to avoid collision, as required by law; but this rule does not require the steersman to change from one side of an approaching vessel to the other, for this would not unfrequently end in confusion and accident. In the night time, the course of other steamers is ascertained by means of the two signal lights, at the bow and stern, which each steam vessels carries.

The forward lights are placed outside the bow, on each side of the stem and inclosed, except in front, so as not to interfere with the view of the pilot or steersman, while the stern lights are hoisted upon the flag-staff at the taffrail, some 40 or 50 feet above the deck. The comparative *distance* of these or other lights cannot always be well determined, but the *low* light is known to be at the bow, and the *high* light at the stern, and according to the angle or distance at which the low light is subtended to the right or left of the high one, is the course of the approaching steamer with entire certainty determined; and the probable changes to be expected in her course, if any, are known by her position in the channel way and her probable destination. Thus, nearly all sources of uncertainty and confusion are avoided, by means which are at once both simple and effectual.

I have seen it recommended to place lights of different colors on the paddle covers; but this can only serve to distinguish steamers amid a multitude of other lights and in a very crowded navigation. Nor should lights ever be carried in such a position as by their glare or reflection will embarrass the night view of the steersman; and by exposing as few lights as possible, a great source of confusion is avoided. I also hold it as assential, that a steam vessel should be steered from the highest portion of her central or forward body, by means of a wheel and tiller ropes, and that in narrow waters or a crowded channel the *cun* of the vessel should be assumed only by an officer or pilot standing at the wheel, who *feels* the helm while he has also the advantage of an unobstructed view.

You will find annexed, a copy of the principal sections of the steamboat law of the State of New York, marked [A.]* This statute is not recommended on account of its penal enactments, which being probably designed to allay popular apprehensions, have been chiefly fortuitous, and are mainly inoperative; but as exhibiting our practical system for the avoidance of collisions, which has very properly found place among its provisions.

III. *Accidents by fire.*—This being a subject to which the common observation and attention of mankind are largely directed, it appears hardly necessary to discuss it on the present occasion. In addition to other securities, good forcing pumps with air chambers and hose, having the essential qualities of a fire engine, should always be provided, both near the boilers and furnaces and in situations above deck which will be always accessible, in case of being driven from the former by accidents of fire or steam.

IV. *Accidents by explosions, or injurious escape of steam.*—This is doubtless the chief topic which claims our consideration on the present occasion.

As regards the means which are now chiefly relied on as affording security from steam explosions, such as careful and intelligent management,

* This law may be found in the Revised Statutes of New York.

the providing of good safety valves, gange taps, glass water guages, pressure thermometers, mercurial pressure guages, and the like, I am not aware that anything new and useful can now be offered; and am convinced that if due attention to these, could have insured entire safety, it would have been already attained. But an attentive consideration of the various accidents which have occurred within the circle of my observation, and of those also which have come to my knowledge through the publications of the day, has led me to the following conclusions:—*First*, that accidents, more or less serious, must be expected sometimes to attend the use of the steam engine, as well as all other efforts or combinations of human skill, and that the interests and safety of the public are not best promoted by resorting to a system of onerous and penal legislation in regulating its use. *Second*, that a very great proportion of the steam accidents which have occurred on both sides of the Atlantic, have been owing chiefly to defects in the general system of construction, and not, as has been very generally supposed, to the want of cautionary apparatus, or the gross neglect of those who were intrusted with the executive duties.

The last conclusion, though at variance with opinions which are extensively entertained, may also be sustained by a careful examination of the degree of strength which is afforded by the weakest portions of common steam boilers, as compared with the maximum pressure and incidental hazards to which they are liable. This want of a sufficient disparity between the maximum of force and the minimum of resistance, will appear still more obvious by extending the conparison to other structures or effective laboring machines of like metal, where, in all important cases, it is believed, a much greater proportionate strength is usually found than pertains to steam boilers of the ordinary construction.

But however this may be, it appears certain that in this quarter, the accidents to steam boilers have been nearly in proportion to their deficiency in comparative strength. This point deserves, however, a more complete elucidation than can be attempted at this time, and I therefore refer to a communication to the Hon. Secretary of the Treasury of the United States on the general subject, which I prepared a few months since in compliance with a resolution of inquiry which was passed by Congress; a copy of the same is hereto annexed, marked [B.]*

It is obvious that there are few uses to which metals are applied, which demand so much attention to strength and security, as in the manufacture of steam boilers. These should be so constructed as to be guarded, on this point, against all contingencies of use which are likely to occur.

If an examination of the English and American steam vessels should show a degree of deficiency on this point, the cause may be readily found in the influence of habit, of prevailing opinions and of previous examples, which have had their origin in an early stage of the art; and also in considerations of practical convenience and facility of manufacture. That the warnings resulting from the various disasters which have occurred, have failed to some extent in their preventive effects, is probably because the theoretical opinion has been honestly and seduously cherished, that these accidents have occurred only through the culpable carelessness and neglect of those in immediate charge of the boilers; and the evil is thus in some degree rendered permanent.

That the safety of steam boilers from explosions does not necessarily depend upon working with so low a pressure as five or seven pounds to the square inch, and that a reasonable increase in the proportionate strength of the boilers in steam vessels would remove all immediate hazard, and

* For a revised copy of this communication see Appendix [B.]

nearly end the catalogue of these disasters, is rendered apparent by the facts which relate to this branch of navigation as it has been carried on in various directions from the city and port of New York. Here, where steam navigation was first successfully established, and where it has probably attained its highest degree of efficiency, we might have expected that accidents and disasters would, not unfrequently, attend the use of a power at once so novel and energetic. The accidents and fatalities which have here occurred, as well as their probable proportion to the pressure of steam, the number of boats employed or trips made, the number of miles navigated, and the number of passengers which from time to time have been exposed, may be seen in the annexed table.

This table, so far as relates to the service performed on the different routes and the number of persons exposed, is made up approximately, by estimates founded on my general acquaintance with our steam navigation; but is believed to be sufficiently correct for general purposes. I have separated the business of the fifteen years which it comprises, into three several periods of five years each; commencing with 1824; early in which year the navigation in this State, which had previously been controlled by the associates of Fulton and Livingston, was thrown open to public competitors.

It appears from the average results of this table, that during even the first period of five years after the navigation was thrown open to public competition, the ratio of steam accidents was only equal to one, for more than 20,000 trips or passages; and that the average loss of life is only equal to one, for more than 126,000 passengers exposed. Thus, at the fair outset of this noble enterprise, a degree of safety was attained for the passenger, such as may well challenge comparison with any artificial means of transit or locomotion that have ever been resorted to by the human race.

It appears further, on comparing the results for these several periods, that the ratio of steam accidents for the first and third periods, as compared with the probable number of trips made, has decreased from one in 20,317 for the first period, to one in 317,105 for the third or latest period; showing a diminution of the ratio of accidents in the average period of ten years equal to *about* 84 *per cent.* The ratio of lives lost from these accidents during the same period, has also decreased from one in 126,211 to one in 1,985,787; equal also to a diminution in the ratio of personal hazard, in this short period, of 84 *per cent.*

It appears also from this table, that during the first of these periods, the average number of miles navigated by all our steamboats, to each explosion which occurred, was equal to 235,646; a distance equal to many times the circumference of our globe, and about equal to that from the earth to the moon. But even this ratio has been rendered tenfold more favorable in the short average period of ten years, being for the latest five years, 2,733,725 miles navigated for each explosion; or more than eleven times the distance from the earth to the moon; and reducing the ratio of hazards in proportion to distance, *almost* 90 *per cent.**

[* The results of a like examination extended to the whole Atlantic tide waters, and the great lakes, it is believed, would be no less favorable. But it will doubtless be supposed, that on our western rivers the ratio of accidents and hazard by steam explosions must have been far greater. This is probably true, in a degree; owing to the ultra and improvident system of high pressure construction which there prevails. But let the inquiry be strictly made, upon the above principles of analysis, and it may serve to show how uncertain a test of the real hazard is found in public prejudice, or individual apprehesion. The constructors and managers of western engines and steamboats owe it to themselves, to their profession and the public, to make this inquiry; so that the faults, or the safety of their favorite system of engineering may fully appear. If a scheme of penal enactments shall there be found necessary and available for the protection of human life, which I cannot readily believe, let it be confined to those waters which are above the flow of the tide; or, which I deem better and more efficient practice, let their present system be either modified or discontinued.]

A Tabular Estimate of the amount of Steam Navigation connected with the Port of New York, the number of passengers carried, and the steam accidents, together with the average and comparative hazards which have attended the same, for two successive periods of 5 years each, beginning with 1824 and ending with 1833.

	First period, from 1824 to 1828, both inclusive.												Second period, from 1829 to 1833, both inclusive.										
ROUTES FROM NEW YORK.	length of route, miles	Probable number of passages per year.	Probable number of passengers and crew exposed on each trip.	Estimated number of trips made in the five years.	Aggregate miles navigated in the five years.	Estimated number of persons exposed in the several trips during the five years.	number of accidents.	Number of lives lost.	Ratio of accidents to whole No. of trips.	ratio of loss to whole No. of exposures.	Estimated average pressure of steam used in 1825.	Probable number of passages per year.	Probable number of passengers and crew exposed on each trip.	Estimated number of trips made in the five years.	Aggregate miles navigated in the five years.	Estimated number of persons exposed in the several trips during the five years.	number of accidents.	Number of lives lost.	Ratio of accidents to whole No. of trips.	ratio of loss to whole No. of exposures.	Average pressure of steam in this period.
Albany and Troy,	150	1,850	120	9,250	1,387,500	1,110.000	1*a*	3	1/925	1/370000	7 lbs.	2,294	150	11,470	1,720,500	1,720,500	2*h*	18	1/873	1/95563	14 lbs.
Hudson and Catskill,	120										to the	160	80	800	96,000	64,000					to the
Kingston and Rhinebeck,	90										squ're	160	40	800	72,000	32,000					squ're
Poughkeepsie,	75										inch.	160	40	800	60,000	32,000					inch.
Newburgh, Fishkill, etc.	60	320	80	1,600	96,000	128,000						400	80	2,000	120,000	160,000					
Peekskill and *Sing Sing*,	40	320	60	1,600	64,000	96,000	1*b*	1	1/1600	1/96000		500	70	2,500	100,000	175,000	1*i*	15	1/2500	1/11666	
Haverstraw and Tappan,	35											240	40	1,200	42,000	48,000					
Fort Lee,	8																				
Jersey city and Hoboken,	1-2	16,600	12	83,000	103,750	996,000	1*c*	2	1/83000	1/498000		30,000	14	150,000	187,500	2,100,000					
Elizabethtown, Amboy, & New Brunswick,	40	1,120	80	5,600	224,000	448,000	3*d*	20	1/1866	1/22400		1,600	100	8,000	320,000	800,000					
Staten Island,	6	1,120	40	5,600	33,600	224,000						1,600	45	8,000	48,000	360,000					
Newark,	22											1,120	60	5,600	123,200	336,000					
Middletown Point, etc.	18											120	40	600	10,800	24,000					
Shrewsb'y, Rockaway, etc.	22	120	40	600	13,200	24,000						120	40	600	13,200	24,000					
Brooklyn, Williamsburgh,	1-2	25,000	10	125,000	62,500	1,250,000						45,000	12	225,000	112,500	2,700,000					
Charleston, *S. C.*	700											24	60	120	84,000	7,200					
Flushing Bay, etc.	12	700	30	3,500	42,000	105,000						800	35	4,000	48,000	140,000					
New Rochelle, etc.	20																				
Sawpits, Norwalk, and Bridgeport,	55	480	60	2,400	132,000	144,000						600	80	3,000	165,000	240,000					
New Haven,	74	360	40	1,800	133,200	72,000	1*e*		1/1800			500	50	2,500	185,000	125,000	1*j*	9	1/2500	1/13888	
Connecticut river,	160	210	60	1,050	168,000	63,000	1*f*	3	1/1050	1/21000		360	80	1,800	288,000	144,000	1*k*	20	1/1800	1/7200	
New London and Norwich	135	160	50	800	108,000	40,000						160	60	800	108,000	48,000					
Stonington,	135																				
Rhode Island,	200	240	60	1,200	240,000	72,000						300	80	1,500	300,000	120,000					
Unlocated boats, (say)*	25	160	30	800	20,000	24,000	4*g*	9	1/200	1/2666		100	40	500	12,500	20,000					
Totals and average results,		48,760		243,800	2,827,750	4,796,000	12	38	1/20317	1/126211	7 lbs.	86,318		431,590	4,216,200	9,419,700	5	62	1/12318	1/151031	14 lbs.

A Tabular Estimate of the amount of Steam Navigation connected with the Port of New York, the number of passengers carried, and the steam accidents, together with the average and comparative hazards which have attended the same, for five years, beginning with 1834 *and ending with* 1838.

Third period, from 1834 to 1838, both inclusive.

ROUTES FROM NEW YORK.	length of route, miles	Probable number of passages or trips per year.	Probable number of passengers and crew exposed on each trip.	Estimated number of passages or trips made in five years.	Aggregate miles navigated in the five years.	Estimated number of persons exposed in the several passages during five years.	number of accidents.	Number of lives lost.	Ratio of accidents to whole number of trips.	Ratio of loss to the whole number of exposures.	Aggregate pressure of steam in 1839.
											18 lbs. to the sq. in.
Albany and Troy,	150	2,738	200	13,690	2,053,500	2,738,000	1	2	$\frac{1}{13690}$	$\frac{1}{1368000}$	18 lbs.
Hudson and Catskill,	120	240	100	1,200	144,000	120, "					
Kingston and Rhinebeck,	90	320	60	1,600	144,000	96, "					
Poughkeepsie,	75	160	80	800	60,000	64, "					
Newburgh, Fishkill, etc.	60	480	80	2,400	144,000	192, "					
Peekskill and Sing Sing,	40	660	80	3,300	132,000	264, "					
Haverstraw and Tappan,	35	240	60	1,200	42,000	72, "					
Fort Lee,	8	800	40	4,000	32,000	160, "					
Jersey city and Hoboken,	1·2	40,000	16	200,000	250,000	3,200, "					
Elizabethtown, Amboy, & New Brunswick,	40	1,800	130	9,000	360,000	1,170, "					
Staten Island,	6	2,240	50	11,200	67,200	560, "					
Newark,	22	1,120	80	5,600	123,200	448, "					
Middletown Point, etc.	18	160	50	800	14,400	40, "					
Shrewsby, Rockaway, etc.	22	160	50	800	17,600	40, "					
Brooklyn, Williamsburgh,	1-2	72,000	15	360,000	180,000	5,400, "	6		$\frac{1}{3710}$	$\frac{1}{3722000}$	
Charleston, S. C.	700	48	80	240	19,200	168, "					
Flushing bay, etc.	12	800	40	4,000	48, "	160,000					
New Rochelle, etc.	20	360	50	1,800	36, "	90, "					
Sawpits, Norwalk and Bridgeport.	55	500	100	2,500	137,500	250, "					
New Haven,	74	600	60	3,250	222,000	180, "					
Connecticut river,	160	450	100	2,500	360, "	225, "					
New London & Norwich,	135	220	70	1,100	145,500	77, "					
Stonington,	135	1y.480	70	480	64,800	33,600					
Rhode Island,	200	500	100	2,500	500,000	250,000					
Unloaded boats, (say)*	25	150	50	750	18,750	37,500					
		127,226		634,210	5,467,450	15,886,300	2	8	$\frac{1}{317163}$	$\frac{1}{1684727}$	18 lbs.

* The miscellaneous business is doubtless greatly underrated.

a Constitution.
b Franklin.
c Jersey.
d Etna, (high pressure,) Bellona, Legislator.
e Hudson.
f Oliver Ellsworth.
g Fidelity, Patent, Caroline, ——.
Average number of miles navigated to each explosion, 235,646

h Ch. J. Marshall; Ohio.
i General Jackson.
j United States.
k New England.
Average number of miles navigated to each explosion, 843,240
l Novelty, high pressure, 1837.
s William Gibbons, January, 1836.
Average miles to each explosion, 2,733,725

[N. B. Accidents other than by steam were not included in the above Table; only one of a fatal character being recollected, which happened at sea. The calamitous loss of the Lexington, at a more recent period, will doubtless inspire additional caution in all future navigation. In reference to the comparative and increasing safety of steam navigation, which may be deduced from the above Table, it is proper to notice, that a large portion of the above consists of a regular and unremitted *night navigation*, which is carried on in every variety of weather.]

This remarkable diminution of accidents and hazard, it may be seen, has taken place in the very period in which the average working pressure of steam has been more than doubled. It has also been attained solely by

professional skill and experience, and without any aid from legislative interference; for the law of Congress on this subject was not in force till near the close of the year 1838. Had such a system of legeslation been at first adopted, there are sound reasons for concluding that it would not have prevented disasters, but might have greatly retarded the rapid advance in safety, as well as improvement, which has been so happily attained.*

It must not be supposed, however, that the average pressure of steam now used on the New York steamboats can be generally increased without incurring material hazard. The thickness which is found most suitable for boiler metal and the practical and economical limits of form and size, are such as should prevent us from allowing a maximum pressure exceeding one and a half or two atmospheres above the common boiling point, for condensing engines; with an addition of about one atmosphere for high pressure engines, which are worked without a condenser and air pump. To these limits, *if an adequate system of boiler construction be adopted* the pressure may with safety be carried, as is done in locomotive engines, in the use of which, owing to a better system of construction, fatal accidents have been less frequent, perhaps, than with low pressure marine engines.

I annex also a copy of the law of the United States, entitled, "An Act to provide for the better security of the lives of passengers on board of vessels propelled in whole or in part by steam."

It may be proper to remark, that the passage of this law was unexpected to the owners of steam vessels, and that it appears to have been considered by Congress itself as a premature measure, as may be inferred from the resolutions for instituting an inquiry on this subject which were passed at the same period.

* [January, 1840. On the 13th of the present month, the steamboat Lexington took fire on Long Island Sound and was destroyed. By this frightful disaster 124 lives were lost, and only four persons escaped. The loss of this vessel was, perhaps, owing to the combustible nature of the materials in which the fire broke out, the want of immediate and concerted action to arrest its fatal progress, and the panic which appears to have prevailed on board. To these circumstances, and especially to the latter, is ascribed the extraordinary destruction of life; all the boats having been lowered and lost while the engine was running at full speed.

The loss of a large amount of property by the owners and managers of the Legington, and the destruction of thirty-nine valuable lives of persons in the service, might have shown that no reasonable motive or provision was likely to have been wanting to secure safety for all on board, whatever may have been the momentary errors or indiscretions of the crew or passengers. Those who have labored to inflame the public against these unfortunate men may well be reminded, that it is now thirty years since the public have enjoyed the use of passenger vessels impelled by fire and steam, and that during this period not less than *thirty millions of persons* have been transported from time to time, in the various steamboats which have to run to and from the City of New York, and that these steamboats probably navigated a distance equal to *fifteen millions of miles*, and that in all this prolonged and varied exposure, *never before has a single life been lost by the burning of a steamboat.* This fact alone, to the unprejudiced, speaks volumes in favor of the general care and skill of the parties who have been concerned in this species of navigation.]

More recently a bill has been reported to the Senate of the United States, near the close of the last session, designed as a substitute for the existing law.

This bill it will be perceived, embodies nearly all the precautionary measures which have been suggested in various quarters for preventing steamboat accidents, and for enforcing these prescriptive measures, an onerous and complex system of penalties is provided in the bill; the owners managers and officers of steamboats being apparently viewed, as in the present law, as a class having feelings and interests which are adverse to the safety and welfare of the community. Of the great error of this newly assumed principle in legislation, or of the practical value of such a system of enactments, it is not my purpose further to inquire; these being questions which relate solely to American legislation. Nor is the slightest disrespect intended to the views of the honorable and highly intelligent Senator who reported this bill; who doubtless considered it to be his duty thus to prepare for more mature consideration, the various projects for securing safety, which had been urged upon his attention.

I have long been convinced, however, that governments should not attempt to become responsible for the prevention of accidents to the boilers or machinery of steam vessels, any more than for the errors and failures of any other machines or fabrics; and that the remedies for these accidents must be sought elsewhere than in legislative enactments, which should relate only to matters which may partake of the character of conventional regulations, for the general convenience and safety of navigation. The most available and useful legislative provision for these accidents, I conceive to be that which shall provide in every case of explosion or injury by steam, for a thorough investigation of all the fact and circumstances which may tend to throw any degree of light upon either the immediate or the remote causes of the disaster; and this inquiry, I think, should be instituted solely for public benefit in the promotion of correct knowledge; and be conducted at public expense.

With my best wishes for the success of the important inquiry in which your are engaged, I subscribe myself, dear sir,

Your most obedient servant, WM. C. REDFIELD.

(To be continued.)

REPORT OF THE JOINT BOARD OF DIRECTORS, TO THE STOCKHOLDERS OF THE DELAWARE AND RARITAN CANAL, AND CAMDEN AND AMBOY RAILROAD AND TRANSPORTATION COMPANIES, ON THE COMPLETION OF THEIR WORKS.

(Continued from page 281.)

SECTION 4.—*From the Lower Depot near Trenton to New Brunswick. The length of this is* 24 *miles* 1 *chain.*

It was commenced to be graded in June, 1838, and the rails were laid and passengers passed over the road, in full operation, on January 1st, 1839.

It follows the tow-path of the right bank of the Delaware and Raritan Canal, to a point near Kingston, a distance of 13 miles 20 chains; thence up the valley of Heathcote's Brook, to its summit, between it and Lawrence's Brook, on what is called the Long Bridge Farm; thence down Lawrence's Brook to Dean's mill dam, near George's road; thence in a straight line, in the direction of New Brunswick, to its intersection with the New Jersey railroad, about three and a half miles from the railroad bridge over the Raritan River, at New Brunswick.

The formation of the road is as follows: In excavation, the road is constructed 14 feet in width; slopes one and half foot base to one foot perpendicular height; ditches three feet deep, two feet wide at the bottom, eleven feet wide on the grade of the road. Embankments are fifteen feet wide on grade of road; slopes the same as in excavation; ditches always three feet below the grade of the road. Wherever there were sods, on the line of the road to be excavated, they were placed on the slopes of the embankments, to protect them from washing.

Superstructure.

A distance of 16 miles on different parts of the line, it is as follows: stone blocks two feet square, and not less than five inches thick, for the foundation, at the joints of the rails; cross sleepers of locust, eight feet long, and six inches square, resting upon them, with a cast iron chair, weighing twelve and a half pounds, resting upon the locust, for the purpose of receiving the iron edge rail, (which rails are of the same pattern as that already described, except that it weighs forty-seven and a half pounds per yard), which is fitted in the chair, by cutting the lower edge or base of the rail an eighth of an inch on each side; between the joints of the rails, (the rails being sixteen feet in length), are laid from ten to eleven cross sleepers of oak and chestnut, seven feet long, four and a half inches thick, and not less than six inches flat surface, rest immediately upon the surface of the ground, the rail resting on these sleepers, making so many bearings, fastened by hook-headed spikes, five to seven inches long, each weighing a third of a pound; the joints of the rails connected as before described in section 1.

In consequence of the ground not having settled sufficiently, the remaining distance of eight miles one chain, was laid without the stone blocks at the joints, but with locust cross sleepers at the joints of the rails, and intervening cross sleepers, the same as those with stone blocks, at the joints; except twenty chains that has cross sleepers, with white pine plank, four and a half inches thick, twelve inches wide, and sixteen feet long, laying upon them, in line of the road; upon these plank are placed the edge rail, spiked and secured as before described. It was laid in this manner, in consequence of its having been laid with wood rail, and flat iron bar, in the first instance, for want of edge rail.

There is also a distance of thirty chains laid with iron, similar to the New Jersey railroad, with cast iron chairs.

There is but one bridge on this section, over the Millstone River. It is of wood, sixty feet long, with stone abutments, constructed upon the new plan, as described in section 1.

SECTION 5.—*Extends from Trenton to Delaware Bridge. Distance* 1 *mile* 30 *chains.*

This road was originally laid with flat iron, two and a quarter inches by five-eights of an inch thick, wood rail, of yellow pine, six by six inches, cross sleepers of oak, and shoes or mud sills of plank, three inches thick, and twelve inches wide, laid in the usual manner.

For seventy-six chains, the flat rail has been taken off, and replaced with cross sleepers and edge rail. Cross sleepers, of locust, eight feet long, six inches square, are placed at the joints of the rails; oak and chestnut sleepers, the same dimensions as on section 4, laid four feet apart, and short blocks of wood between them, with cast iron chairs, spikes and fastenings, as before described.

There remains thirty-four chains of wood rail and flat iron, laid as bove.

Distance of road from depot at Trenton, is thirty chains, to the depot at the canal lock; thence to the Delaware bridge, one mile.

LOCOMOTIVES, CARS, STOCK, ETC.

17 locomtives; 64 passenger cars; 7 baggage cars; 64 transportation cars for merchandize; 24 dirt cars, etc., for use on road.

Steamboats on the Delaware river.

Steamboat "New Philadelphia;" "Burlington;" "Philadelphia."

Steamboats between New Brunswick, South Amboy and New York.

Steamboat "Independence;" "Swan;" "Trenton;" New York;"—"Thistle."

Account of the Receipts of the Delaware and Raritan Canal Co. *Dr.*

To cost of the Delaware and Raritan canal per J. R. Thomson's (Sec.) statement,	$2,829,797 36
Bills paid and not included in the above statement,	14,307 67
Balance due for advances to Camden and Amboy railroad, and transportation company,	18,203 86
Notes of hand unpaid,	1,910 00
Cash on hand,	12,334 47
	$2,876,643 36

Cr.

By capital stock paid in,	$1,496,000 00
By cash from loans,	1,279,278 88
By loans paid interest, and for real estate per loan account,	45,627 92
By rents from water power,	5,185 15
By balance of running account.	50,551 41
	$2,876,643 36

JAS. NEILSON, *Treasurer.*

Abstract of the cost of the Delaware and Raritan Canal.

Canal Sections, Embankments, Excavations, Waste Weirs, &c.,	$1,354,372 50
Locks,	285,256 28
Culverts,	160,853 52
Bridges,	88,971 82
Fences,	26,387 04
Peir and Harbour at New Brunswick,	22,016 50
Wharfing,	8,379 99
Dredging Machine and Dredging at Bordentown, Bull's Island, and improving Raritan River, in addition to the sums received on this account from the United States,	26,841 88
Timber,	132,509 69
Cement,	93,240 45
Real Estate,	271,000 66
Damages,	33,989 80
Engineer Department,	84,496 19
Legal Expenses,	15,299 91
Office Expenses,	1,653 14
Contingent Expenses,	35,573 42
Salaries to the time of completion,	38,526 35

Barges,	319 23
Smith Shop,	1,427 77
Interest to the time of completion,	100,529 07
Towing Establishment, Horses, Harness, &c.,	9,876 39
Loan Expenses, 1st English Loan,	15,460 00
Railroad Iron, balance,	3,936 05
Due by Contractors,	1,506 77
	$2,829,797 36

JOHN R. THOMSON. *Sect.*

Dividend account of the Delaware and Raritan Canal. *Dr.*

To current expenses per J. R. Thomson's (Sec.) account,	$210,344 42
To cash paid E. A. Stevens on dividend account,	46,000, 00
To ballance to construction account,	50,551 41
	$306,895 83

Cr.

By tolls to Dec. 1, 1839,	$306,895 83

JAS. NEILSON, *Treasurer.*

Joint account of receipts and expenditures of the Delaware and Raritan canal, and Camden and Amboy railroad and transportation Cos. *Dr.*

To instalments from stockholders,	$2,996,000 00
To receipts from loans including temporary loan of $14,640 42,	2,848,469 44
To borrowed from the dividend of Camden and Amboy railroad and transportation Co. for the construction of the road,	$131,071 29
To rents received by do.	5,322 16
To sundries received by do.,	1,543 54
To balance per construction account of C. & A. R. R. & T. Co.,	170,025 79
To rents from water power from the D. &. R. Canal Co.	5,185 15
To balance of dividend account from do.,	50,551 41
	$6,208,168 78

Cr.

By cost of construction of the Camden and Amboy railroad and branch road per statement,	$3,220,848 39
By cost of Delaware and Raritan canal,	$2,829,797 36
By bills paid and not included in the above,	14,307 67
By notes of hand unpaid,	1,910 00
By cash on hand,	12,334 47
By cash advanced for building boats and increasing the transportation of coal through the canal,	117,000 00
By loan expenses in England,	11,970,89
	$6,208,168 78

JOHN R. THOMPSON, *Sec. Joint Board.*

Abstract of the annual receipts and expenditures of the Delaware and Raritan canal from 1834 *to* 1839 *inclusive.*

TOTAL RECEIPTS.		TOTAL EXPENDITURES.	
1834	$11,604 19	1834 }	$40,242 74
1835	47,141 92	1835 }	
1836	54,801 22	1836	34,764 89
1837	67,194 26	1837	27,079 21
1838	73,507 24	1838	46,007 72
1839	74,843 52	1839	44,698 48
		December,	8,550 38
	329,092 35		210,344 42
Deduct allowances made on coal, merchant's line, &c., per order,	22,196 50	Balance to dividend account,	50,551 41
		Paid on account of dividends.	46,000 00
	$306,806 85		

JOHN R. THOMPSON, *Sec.*

Summary of Cost of the Camden and Amboy Railroad, Branch Road and Appendages.

Grading,	$379,721 76	Locomotives,	$123,840 67
Engineering,	94,294 77	Iron,	10,372 08
Wharfing,	55,644 55	Locust,	13,447 70
Stock and tools,	48,955 05	Printing,	1,679 32
Incidental Exp's,	32,384 90	Interest,	104,242 64
Timber,	121,153 65	Wood Rails,	7,310 57
Stone,	37,314 14	Steamboats,	420,153 57
Office Expenses,	1,058 20	Property in trust to pay debts,	8,543 04
Real Estate,	371,769 68	Canal passage barges	1,832 28
Culverts,	17,112 91	Sleepers,	35,170 60
Salaries,	26,858 22	Fencing,	2,245 35
Damages,	4,579 71	Salting Timber,	6,352 61
Carpenters,	5,482 85	Stable Expenses,	36 89
Legal Expenses,	6,701 51	Phil. & Tr. Railroad,	46,569 54
Masonry,	14,768 36	Stone Rails,	3,457 59
Smithery,	10,067 08	Taxes,	209 09
Bridges,	78,459 37	Pine Wood,	75 12
Broken Stone,	103,372 64	Coal Lands,	25,000 00
Iron Rails,	517,907 62		
Gravelling,	22,223 44		$3,222,204 84
Trenching,	27 998 14	Deduct credits,	1,347 87
Stone Blocks,	111,524 73		
Laying Rails,	155,346 46		$3,220,857 02
Cars,	140,742 88		
Ditching,	26,232 61		

E. A. STEVENS.

ON THE PREVENTION OF ACCIDENTS, BY FIRE, ON BOARD OF STEAMBOATS. BY ITHAMAR A. BEARD, CIVIL ENGINEER.

Much has been writen and published on the prevention of accidents on board of steamboats by the bursting of boilers or the collapsing of flues; and I fear much more will be required to prevent all accidents and fatal catastrophes in boats, which, in too many instances I believe, to arise from

a want of due caution on the part of those whose business it is to guard the lives and property of the public, confided to their skill and watchful care.

Besides the ordinary class of accidents, there is another class of which we have on record several accounts within a few years, and one very recently, of a still more awful and distressing nature. I have reference to the burning of a boat at sea, where the passengers and crew have no alternative, but must either burn or drown.

I do not recollect having read any efficient mode proposed for extinguishing fire on board a boat, nor any other theory recomended than the ordinary mode with buckets and a fire engine.

Believing that there is always ready at hand and available, with proper fixtures, in every steamboat, an agent much more efficient than water and an ordinary engine to extinguish fire. I deem it a duty to make the suggestion, that others who may be disposed, and have better means than I can command, may try experiments upon it, and test the utility of the theory.

From the few imperfect experiments my means have permited, I am of opinion, that steam is far preferable to water to extinguish fire. For steam can be made to enter every apartment, birth, and crevice, even where water could not possibly be thrown, and being lighter than air it keeps the space filled instead of falling to the bottom as water would do, and can be as effective on the under side of a ceiling, deck, or floor as it would be on the top, and even more so.

The first that I ever noticed of the effect of steam upon flame was several years since, by carrying a lighted lamp into a room in a dye-house that was filled with steam, and the light was instantly extinguished.

Again, when the steam was issuing from the nose of a teakettle, I have taken a bright coal of fire and held it in the steam, and the fire was quenched in as short a time as if it had been immersed in water, and as effectually through the coal.

Now if the theory be true (which, I confess, needs further experiment and stronger proof) a comparatively trifling expense may furnish every steamboat with certain and available means of readily extinguishing a fire, if it should take in the woodwork of the boat, or in the freight, either on or under deck.

I would propose the following mode of operation. Let a pipe, say a gas pipe, or any other that shall be of strength sufficient to bear the pressure of the steam, be connected with the boiler, either directly or indirectly, at pleasure, and be carried to every apartment in the boat. And in as many places as may be thought expedient, insert stopcocks of such construction that they can be readily and easily opened at any time and by any person.

In case of a fire in any apartment the occupants would of course leave the apartment as soon as possible, and when the apartment should be vacated, let the stopcocks be opened, and force in as much steam as would be practicable. Under deck, and in a close apartment, it would have a double advantage over water, for it would, in a great measure, exclude the air from feeding the flame, at the same time it produced an effect by its moisture, but the greatest effect would undoubtedly be produced by the excluding of the air.

In addition to the foregoing, I would attach pipes and carry them on each side of the engine, fore and aft, upon the deck some thirty or forty feet, and at the terminations, I would affix "gooseneck joints," and to these attach several lengths of pipe in joints of six or eight feet, and then another "gooseneck" and to this attach a directing and discharging pipe

of about the same length as the other joints, all the connections to be made with screw joints, or couplings.

The two goosenecks would enable the man having charge of the pipe to convey and use the steam on any part of the deck, with nearly as great facility as water would be conveyed and used with a hose: and, if necessary, any number of goosenecks may be used.

To enable the men to handle and use the pipes without burning their hands, let some two or three feet of each joint of pipe be incased in, or near the middle, with a tin or sheet brass cylinder (brass is preferable,) one inch, more or less, at pleasure, greater than the steam pipes, and fill the space between the two pipes with pulverized charcoal, pipe clay, or soapstone dust, and outside of the exterior cylinder wind on some two or three thicknesses of woolen cloth, and this will fully protect the hands of the men in moving and directing the pipes.

It is thought that this mode of extinguishing a fire in a boat may be more effective than a fire engine, and may always be available at the moment it may be needed, whereas, with a fire engine, there must always be a delay, and frequently, perhaps generally, much difficulty in supplying it with water and in getting it into action, and more difficulty, in the terror and confusion in getting hands to work it; and these unavoidable difficulties, it is presumed, would, in most instances, let the fire get such headway that no power on earth could arrest its progress; and inevitable destruction is the consequence.

In any situation, a single bucket of water when a fire first takes, is of more effect than an ocean after the building is envoloped in flames. And on board a boat, especially, it is necessary to stop the progress of a fire immediately and with the least possible delay, for if the wind did not blow, the motion of the boat would produce a current of air sufficient to kindle a fire rapidly.

In general it would be favorable, in a case of a fire, to run the boat directly before the wind, and this would, in a measure, neutralize its effect; but circumstances might alter the case in this respect.

As too much precaution, to preserve and render life and property safe, cannot be used, whether philantrophic motives, or those arising from self interest on the part of steamboat owners, be consulted, every boat should be well and constantly furnished with every possible means of safety or escape in case of accidents of any kind.

For one such catastrophe as that of the Lexington, is enough to deter thousands who would otherwise patronize steamboats with perfect confidence, from risking their lives and property on board a boat, for years. And unless some sure measures can be adopted and put in general use to render safety more certain to the public than has been the case, in very many instances, every year since steam got into general use as a motive power; this mode of conveyance and travelling ought to be totally abandoned.

But it is thought, by not a few, that most of the accidents are chargeable, in a very great degree, to neglect of duty and proper precaution, and to the want of preventive means on the part of those who own, as well as of those whose business it is to manage steamboats, and that it is fully practicable to render them as safe as any other mode of travelling.

I am not fully confident that there is any value in my hints respecting extinguishing fire by steam; but trust the reader will not impugn my motives even if he shall feel inclined to reject my theory as worthless.

If it have no other value than to draw from other and more ingenious minds some further and better views on the subject that may ultimately lead

to the adoption of better modes to ensure safety, I shall feel fully compensated and highly gratified.—*Journal Franklin Institute.*

Improved railway track.—A patent has been recently issued for improvements in the manner of constructing the tracks of railroads, invented by JAMES HERRON, Esq., Civil Engineer, a gentleman of much practical experience in the particular department of buisiness to which the invention appertains. The defects of the existing modes of construction are too apparent to need insisting upon; the early and very injurious production of both horizontal and lateral undulations not only interferes materially with the tractive power of the locomotive, but is the pregnant cause of a large proportion of the accidents incident to this mode of conveyance. The perpetual necessity for, and the heavy cost of, repairs are also evils of no small magnitude. The improved mode of construction devised by Mr. Herron is intended, among other things, to give a stability to the road which the plans now in use do not afford, and to render the structure of more easy repair, without any increase, and it is believed with a diminution, of the first cost. In the proposed system, the string-pieces which support the iron rails are not to rest in notches made in cross-ties, but are to be connected together by means of plank, firmly secured on their under sides, and extending obliquely from one string-piece to the other, in such a manner as to constitute lateral and diagonal braces, and to prevent all danger of their spreading. These tie-plank are to rest upon the road, which is to be evenly graded for this purpose. The proposed manner of connecting the string-pieces with each other, and with the iron rails and other parts of the track, is intended, and well calculated, to give to the whole a degree of firmness which shall enable any and every part of it to constitute a bridge, over which the locomotive and its train would securely pass, although a considerable portion of the supporting ground might be washed away.

It will be obvious that track thus constructed, as it bears evenly and equally upon every portion of the graded road, will have little or no tendency to settle, except by the settling of the road itself, such as takes place in newly-made embankments, and that it may be raised to its proper level with a facility not offerd by any other mode of structure.

The specification of this patent is of great length, and embraces many devices for securely uniting the frame work of timber, and likewise the iron rails, so as to combine firmness with the requisite degree of elasticity, all of which display the handiwork of one familiar with the business under consideration; and, although they may be said, in several instances, to be untried projects, they are still projects well worth trying, as they must answer the intended purpose perfectly well, even should they not be found so superior to the methods previously in use, as it is believed they will.

The writer of this article has just been informed that it has been determined to give a fair trial to the plan, along a mile or two of road, at a very early day. He has no other interest in the matter than that felt by every citizen who glories in the onward progress of his country. The present moment, it is true, is a most unfavorable one for the trial of new projects; but the existing state of things cannot long endure. The native energy, elasticity, and resources of our favored land will, at an early day, enable us to resume the most important of our public works. Our means of intercommunication must and will be extended; and, in the mean time, it is desirable that we should ascertain and determine the best mode of procedure.

The laying of a mile or two of track upon Mr. Herron's plan would, in one particular, accomplish this object to a certain extent, as, after the lapse of a few months, its relative value would be satisfactorily ascertained.—*National Inteligence.*